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[x] Other **Examiner Yee. Here is a proposed draft response for the above referenced case in connection with a planned request for continued examination. I shall call tomorrow at 9:00 AM. Thank you.**

US09/709,918

1. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate; and

forming a molten alloy and cooling said alloy to form a metallic glass coating on the substrate, the forming comprising forming a successive buildup of ~~continuous layers~~ metallic glass layers, the metallic glass coating having a hardness of at least about 9.2 GPa, and comprising an alloy containing fewer than 11 elements and wherein said alloy contains one or both of molybdenum and tungsten.

2. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate;

forming a molten alloy and cooling said alloy to form a metallic glass coating on the substrate and having a first hardness of at least about 9.2 GPa, the metallic glass comprising fewer than 11 elements; and converting at least a portion of the metallic glass coating to a crystalline material having a nanocrystalline grain size and a second hardness of at least about 9.2 GPa

13. (Currently amended) A method of forming a hardened surface on a substrate, comprising:

providing a substrate;

forming a molten alloy and cooling said alloy to form a metallic glass coating on the substrate; the forming comprising a successive build-up of metallic glass layers, the metallic glass comprising one or more materials selected from the group consisting of $(Fe_{0.85}Cr_{0.15})_{83}B_{17}$, $(Fe_{0.8}Cr_{0.2})_{83}B_{17}$,$(Fe_{0.75}Cr_{0.25})_{83}B_{17}$, $(Fe_{0.6}Co_{0.2}Cr_{0.2})_{83}B_{17}$, $(Fe_{0.8}Cr_{0.15}Mo_{0.05})_{83}B_{17}$, $(Fe_{0.8}Cr_{0.2})_{79}B_{17}C_4$, $(Fe_{0.8}Cr_{0.2})_{79}B_{17}Si_4$, $(Fe_{0.8}Cr_{0.2})_{79}B_{17}Al_4$, $(Fe_{0.8}Cr_{0.2})_{75}B_{17}Al_4C_4$, $(Fe_{0.8}Cr_{0.2})_{75}B_{17}Si_4C_4$, $(Fe_{0.8}Cr_{0.2})_{75}B_{17}Si_4Al_4$, $(Fe_{0.8}Cr_{0.2})_{71}B_{17}Si_4C_4Al_4$, $(Fe_{0.7}Co_{0.1}Cr_{0.2})_{83}B_{17}$, $(Fe_{0.8}Cr_{0.2})_{80}B_{20}$, $(Fe_{0.8}Cr_{0.2})_{76}B_{17}Al_7$, $(Fe_{0.8}Cr_{0.2})_{79}B_{17}W_2C_2$, $(Fe_{0.8}Cr_{0.2})_{81}B_{17}W_2$, and $Fe_{64}Ti_3Cr_5Mo_2B_{16}C_5Si_1Al_2La_2$; the metallic glass coating having a hardness of at least about 9.2 GPa ~~and~~

converting at least a portion of the metallic glass coating to a crystalline material having a nanocrystalline grain size.

Summary of Arguments

- Page 10, lines 6-7 recite that the alloy may contain one or both of molybdenum and tungsten.
- U.S. Patent No. 5,643,531. Kim forms a "homogenous single phase supersaturated solution". Col. 3, lines 31-41. Kim points out that such supersaturated solution has "an unstable structure which can be transformed into the stable amorphous structure with high hardness and toughness under the friction and wear environments." Kim relies upon an unstable structure and friction and wear. Kim does not teach or suggest forming a metal alloy and cooling to form the metallic glass coating. Kim

employs friction and wear as a critical component to achieve hardness and stability.

- Example 1 of Kim. HRc of 55-60. The claimed requirement herein of 9.2 GPa corresponds to HRc of 68.
- Example 3 of Kim, has a Hv of 500-570, which corresponds to HRc of 50-54. Again, this fails to teach or suggest 9.2 GPa.
- Example 4 of Kim discloses an as deposited hardness of 50-52, which corresponds to 5.0 to 5.3 GPa. Again, this fails to teach or suggest 9.2 GPa. Again, this fails to teach or suggest 9.2 GPa.
- Example 5 of Kim, HRc = 55, 45 and 65, which corresponds to 5.8, 4.4 and 8.2 GPa respectively. Again, this fails to teach or suggest 9.2 GPa.
- Kim does appear to provide, only **after** the coating is converted from its unstable form via frictional transformation, a surface hardness of HRc = 70 (10.6 GPa)(Example 1) and an Hv = 1200-1500 (Example 4)(11.8 to 14.7 GPa). However, such hardness is **only** obtained by a second processing step that is obviated by the present invention.
- U.S. Patent No. 5,376,191
- Example 1, Hv = 480. That corresponds to 4.7 GPa.
- Example 2, Hv = 870. That corresponds to 8.5 GPa.
- Example 3, Hv = 550. That corresponds to 5.4 GPa.
- Example 4, Hv = 685. That corresponds to 6.7 GPa.

- Therefore, in all the above examples, the hardness is less than the claimed hardness of at least about 9.2 GPa, and the alloys therein can not be found to teach or suggest a hardness of at least about 9.2 GPa.
- Example 5 of '191 reports that the specific alloy, Fe_{16}, Co_{16}, Ni_{20}, Cr_{10}, Zr_{10}, B_{14}, Si_{14} had a fusion temperature of 1080^{0}C and a Hv_{30} = 1430. This would correspond to a hardness value of about 13.7 GPa. However, as noted above, claim 1 has been amended to recite that the subject alloy contains fewer than 11 elements and that the alloy contain one or both of molybdenum and tungsten. Notably, example 5 of the '191 patent fails to teach or suggest the use of molybdenum and tungsten in combination with all of the other aspects of claim 1 to provide a hardness of at least about 9.2 GPa, and it is therefore believed that claim 1 as amended herein is patentable over the '191 patent under the provisions of 35 USC 102 and/or 103.
- Independent claims 2 and 13 recites forming a molten alloy and cooling the alloy to form a metallic glass coating on the substrate, the forming comprising a successive build-up of metallic glass layers, wherein the alloy is selected from a group of alloys that are recited (in claim 13) according to their individual formulae. Claims 2 and 13 also recite that the metallic glass coating has a hardness of at least about 9.2 GPa and the conversion of at least a portion of the metallic glass coating to crystalline material having a nanocrystalline grain size (claim 2) and having a second

hardness of at least about 9.2 GPa. The U.S. '531 and '191 pat nt fail to teach such aspects of independent claims 2 and 13.

- Applicant is prepared to file a Terminal Disclaimer under 37 CFR 1.321(c) with regards to U.S. Patent No. 6,258,185.